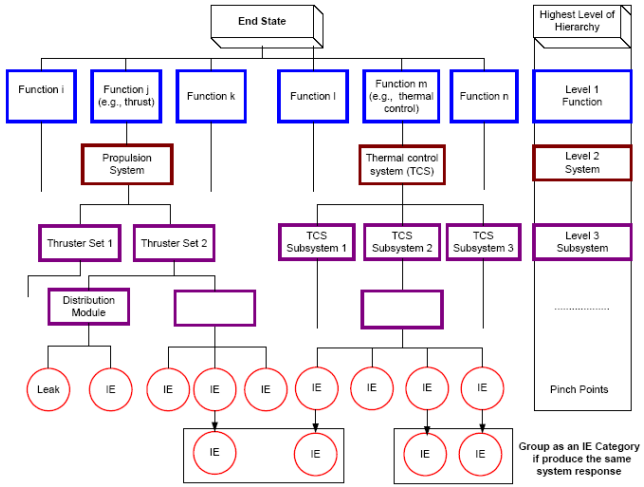
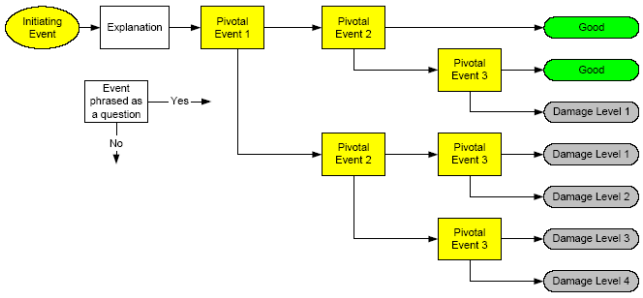
PRA Applications at NASA

- *For Upgrades (Space Shuttle)*
- *For Development, construction and assembly (e.g., International Space Station)*
- *When there are requirements for Safety Compliance (e.g., nuclear missions like Mars '03; Project Prometheus, Mars Sample Return)*
- *In Design and Conceptual Design (e.g., Orbital Space Plane, Mars missions, Project Prometheus)*

Master Logic Diagram



Event Sequence Diagram



☑ YOUR PREPAREDNESS FOR AN AUDIT OF NASA PROBABILISTIC RISK ASSESSMENT (PRA) REQUIREMENTS WITH THESE SAMPLE AUDIT GUIDE QUESTIONS.

MANAGEMENT:

1. Does your program require a Full-scope or Limited-scope/Simplified PRA?
2. Where in your contracts do you implement PRA requirements?
3. How has your program used or how are you planning to use the results of the PRA?
4. Who conducts your program's PRA reviews, and how are the findings implemented in the PRA?
5. How do you ensure that your PRA is correctly initiated, conducted, and utilized within Missions and other programs?
6. How are PRA results used for Continuous Risk Management?
7. What criteria do you have for determining the residual risk is unacceptable?
8. How is the availability of all approved PRA documentation for present and future program/projects assured?
9. What is the process for updating the PRA as new information is obtained?
10. How is the accuracy of PRA efforts and results ensured?

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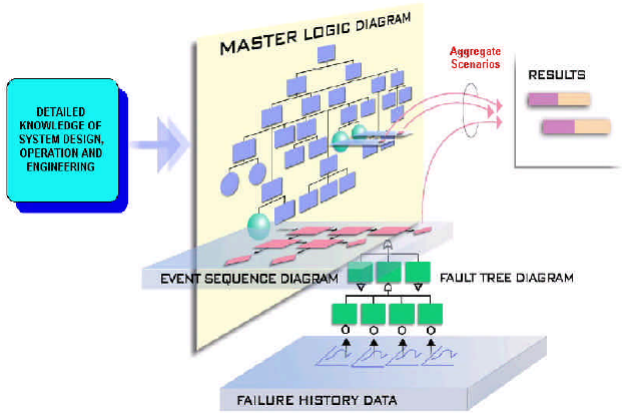
SAFETY AND MISSION ASSURANCE REQUIREMENTS

NPR 8705.5

Probabilistic Risk Assessment (PRA)

Compliance Verification Guide



OFFICE OF SAFETY AND MISSION ASSURANCE

This brochure is intended to be used as a guide only, not as a replacement for the actual policy. To review procedures for NASA Probabilistic Risk Assessment (NPR 8705.5) in its entirety, see http://www.hq.nasa.gov/office/codeq/doctree/texttree.htm.

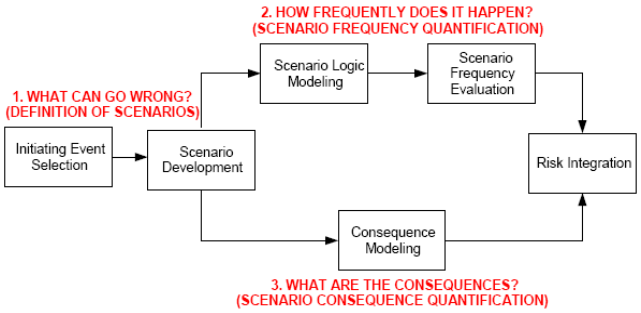
Probabilistic Risk Assessment (PRA)
Provides a structured analysis method aimed at assessing risks in complex technological systems for the purpose of cost-effectively improving their safety and performance.

Three Basic PRA Questions:

1. What can go wrong
2. How likely is it?
3. What are the consequences?

What is the Goal of the Risk Assessment Program?

- Improve risk awareness for Line & Project Managers and personnel.
- Develop a core of in-house risk assessment experts.
- Implement PRA where required and where it would benefit the programs.
- Transition quantitative risk assessment to baseline method for safety assessment.
- Integrate risk assessment with system safety and reliability assessment.
- Adopt Agency-wide risk-informed culture:
  - Risk assessment to become part of the regular assessment methodology for safety and technical performance improvement and for cost effectiveness.
  - Implement Agency-wide risk-informed management process.



Implementation of the Triplet Definition of Risk in PRA

MINIMUM AUDIT POINTS FOR NPR 8705.5

Leadership and Management

- **Mission Associate Administrators**
  - Shall ensure that formal PRA awareness training and methodology training are provided periodically to managers and practitioners.
    - Objective Quality Evidence (OQE) – Training Records
  - Shall ensure that PRA requirements are implemented on contracts.
    - OQE – Contracts Including PRA Requirements
- **The Chief Safety & Mission Assurance Officer** is the lead for PRA policy, procedures, guidelines, technical training content, and tools throughout NASA, and shall:
  - Have primary responsibility for developing criteria and guidelines for the use of PRA results in management decision-making.
    - OQE – Criteria And Guidelines Related To PRA And Decision Making
  - Assess and assure that PRAs are correctly initiated, conducted, and utilized within Mission and programs/projects.
    - OQE – PRA Procedures incorporated into Project/Program Risk Management Plans.
  - Enable, facilitate, and organize the development of a PRA "corporate memory." This includes:
    - Assisting in the maintenance of PRAs and their updating.
    - Collecting documentation of all PRAs conducted, PRA models developed and data used, preliminary and final reports issued, and the results of independent and peer reviews from NASA programs/ projects.
    - Assuring the availability of all approved PRA documentation for present and future programs/projects.
    - OQE – PRA Updates & Maintenance
  - Organize and coordinate PRA peer reviews and assure the implementation of peer review recommendations.
    - OQE – Peer Reviews & Recommended Actions
  - Contribute to and approve program/project Level 1 (NASA Headquarters-level program management) probabilistic risk assessments.
    - OQE – Level 1 Approval Signature

Core Process

- **NASA Program/Project Managers**
  - Shall use the criteria in NPR 8705.5, paragraph 1.2.3, Table 1, and paragraph 1.2.4 to determine when a PRA must be conducted and the scope to be implemented.
    - OQE – PRA Scope within Program/Project Plans
  - Shall maintain and safeguard records resulting from PRAs in accordance with the guidelines in NPR 1441.1, NASA Records Retention Schedule.
    - OQE – Retained PRA Records
  - Shall update design, operating, and implementation plans to reflect insights from PRA and use the insights to reinforce or modify existing relevant management decisions or to generate new management decisions.
    - OQE – Bases for Program Plan Changes
  - If the residual risk is deemed unacceptable, shall consider modifying the project to reduce risk to an acceptable level as appropriate.
    - OQE – Program Management Council (PMC) and Governing PMC Meeting Minutes.

Process Check

- An independent peer review shall be conducted of all full-scope PRAs.
  - OQE – Independent Peer Review